SVE BULLETIN

SPECIAL VEHICLE ENGINEERING – BODY BUILDERS ADVISORY SERVICE

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Bulletin: Q-140 **Date: October 16, 2006**

Wheelbase Modifications – F650/750

To: Recreational Vehicles and Bus Builders (and builders of similar duty cycle applications)

Models Affected: Model years 2004 and later F650 and F750 to be used in a light to moderate duty cycle such as a recreational vehicle or a bus.

Note: For vehicles intended for use in four-wheel drive, medium/heavy duty, commercial, off-road, etc. duty cycles, refer to the Ford Shop Manual.

Action Requested:
Please provide a copy of this bulletin to affected engineering, manufacturing, service, and sub-contractors.

Background:
Modifications to the high-strength/reinforced steel frame of the medium duty F650 and F750 trucks require that special precautions and procedures be followed which are different from those published for light duty truck wheelbase modifications (Bulletin Q-18).

Description:
Shortening or lengthening a wheelbase is an added expense for the customer. Therefore, it is to the customer's benefit to order a chassis from the factory with the desired wheelbase rather than to alter the wheelbase of the chassis on-site.

A. Wheelbase Alterations Overview
The preferred method for altering the wheelbase is to slide the rear axle forward or rearward as required. Invariably, this requires the lengthening or shortening of air lines, brake lines, electrical wires, exhaust, and driveline. Extreme care should be taken in the modification of the air lines, brake lines, electrical wires, exhaust, and driveline to make sure that they operate as reliably as those with which the vehicle was manufactured. Refer to the Ford F650/750 Shop Manual when modifying these systems.

Note that any issues resulting from any modification(s) to any of the above systems or chassis frame may not be covered by the Ford warranty. Experience has shown that extending the wheelbase of a vehicle may alter the frame resonant frequencies such that significant additional frame stiffening may be necessary to avoid undesirable frame flexing resulting in vehicle ride and handling issues.

B. Identification of Frame Rail Material
Chassis are manufactured with frame rails of different alloy steels and some are heat-treated. There is also a factory offering of a reinforced frame. Each material must be handled in a specific manner to assure maximum service life; therefore, the frame material must be determined before attempting frame modification.

Chassis are presently manufactured with frame rails of:
- High strength low alloy (HSLA) steel (50,000 and 80,000 PSI yield strength)
- Heat-treated steel (120,000 PSI yield strength)

Each type has different welding procedures. The frame rail material can be determined by inspecting the frame and consulting the dealer vehicle line setting ticket and the sales data book. (Provide the dealer with the Vehicle Identification Number – VIN).

C. Non-Reinforced Frame Alteration Consideration

- If the wheelbase of a non-reinforced frame is lengthened by sliding back the rear axle, a reinforcement may be required. Generally, this reinforcement may be a type "L" reinforcement of the same strength and thickness as the original frame. If the wheelbase lengthening is more than 12 – 18 inches, a full "C-channel" type reinforcement should be considered in place of the "L" reinforcement.

- In those instances when it is necessary to cut and weld the frame to alter the wheelbase, the frame must be reinforced with a reinforcement of the same strength and thickness as the original frame material in the area where the frame has been cut. It is recommended the reinforcement extends 8 or more inches on either side of the cut. Follow the procedures described in Bulletin Q-18, but use a full "C-channel" type reinforcement in place of the "L" reinforcement. **See precautionary note in "Models Affected:" above. See the "Welding General Procedures" and "Welding Precautions" sections of this bulletin prior to proceeding!**

D. Reinforced Frame Alteration Consideration

If the frame was built with both a main frame and a reinforcement, the reinforcement should be removed locally for a distance of 8 inches (minimum) forward and aft of the main frame cut before cutting the main frame. Skillful use of a saw, grinder, and/or plasma cutter can be used to remove the section of reinforcement, but care must be used to assure the main frame is not compromised. **Any damage (heat or mechanical) to the main frame rail which occurs during the removal of the reinforcement may adversely affect the strength and durability of the resultant wheelbase modification. See the "Welding General Procedures" and "Welding Precautions" sections of this bulletin prior to proceeding!**

1. After the reinforcement section is removed, the main frame is then cut. Mechanical cutting, rather than oxy/acetylene cutting is recommended. Plasma cutting may also be used to minimize the affects of heating the high strength steel of the frame.

2. The cross-section and strength of the inserted main frame member and the inserted reinforcement must be the same as the original.

3. Appropriately fixture the frame sections and the inserted "stretch" sections to assure proper alignment of the frame and insert. Following the "Welding General Procedures and Precautions" sections, weld the stretch insert in place.

4. After grinding the welds flat (inside and outside of the rail), repeat the above for the reinforcement insert.

5. Again, grind the welds flat. Weld a "fishplate" made of the same strength and thickness material over each exposed weld interface (inside and outside of the frame). An appropriately sized diamond plate has proven effective as a "fishplate". See Figure 1. Note that the diamond plate shown on the main frame in Figure 1 is actually welded to the inside of the frame rail, not to the outside as it appears in the figure.

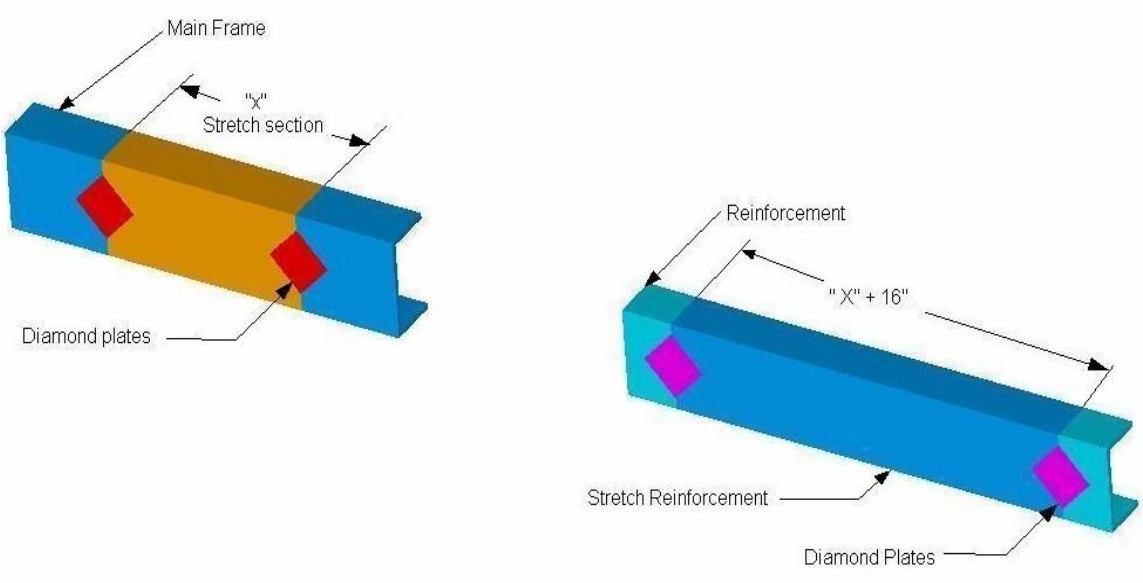


Figure 1

E. Welding Precautions

⚠ WARNING: Invisible ultraviolet and infrared rays emitted in welding can injure unprotected eyes and skin. Protection such as welder's helmet with dark-colored filter lenses of the proper density must be used. GTAW or TIG welding will produce intense radiation, therefore, filter plate lenses of the deepest shade providing adequate visibility are recommended. It is strongly recommended that persons working in the weld area wear flash safety goggles. Also wear protective clothing. Failure to follow these instructions may result in personal injury.

Welding and Plasma Cutting

Note: in instances where plasma or similar cutting processes that utilize a ground cable, extended care must be taken to prevent damage to electronic components of the vehicle.

CAUTION: On any vehicle, disconnect both the positive and negative battery cables from the battery before welding or cutting on the vehicle. Attach the welder ground cable as close as possible to the part being welded or cut.

With an electronic engine controller (PCM), do not connect the ground cable to the control module(s) or the cooling plate. To protect the control module(s), it is mandatory to remove all connectors going to the control modules.

F. General Weld Recommendations for All Steel Sidemembers

Preparation Of Frame

1. **Bevel Inserts (Main Frame and Reinforcement) Prior to Weld:** To make sure of complete weld penetration, bevel the joint from one side when welding from one side. Bevel the joint from both sides when welding from both sides.

2. **Clean Surface to Weld:** Surfaces to be welded and surfaces adjacent to the weld must be free of loose scale, slag, rust, grease, moisture, paint or other material that could contribute to poor quality welds.

Welding Considerations

Electric arc-welding is recommended for reworking of steel frames. The shielded arc method should be used because the heat generated during welding is localized and burning of material is minimized using this method. Additional advantages are that the finished weld can be ground flush and drilled as necessary. Shielded metal arc welding (SMAW); gas metal arc welding (GMAW), also known as metal inert gas (MIG) welding; gas tungsten arc welding (GTAW), also known as tungsten inert gas (TIG) welding; or flux cored arc welding (FCAW) are recommended methods for joining steel frame members.

NOTE: To properly carry out the weld procedure, the following rules must be observed:

1. Welding should not be carried out when surfaces are wet or exposed to rain, snow, high wind or when repair personnel are exposed to inclement conditions. Frames exposed to inclement weather must be thoroughly cleaned and dried before the procedure is performed.

2. Surface areas and edges to be joined must be clean and free of oil, grease, loose scale, rust, moisture, paint or other material that could contribute to poor quality welds.

3. Always avoid craters, notching and undercutting.

4. Peen new welds prior to grinding to relieve stresses caused by shrinkage.

5. Grind all welds flush with the surrounding surfaces. Use a coarse grinder followed by a smooth grinder and grind at 90 degrees to the crack direction to remove all of the coarse grind marks.

6. Inspect the weld area carefully after grinding. Grind out any remaining notches or undercuts and repeat the finishing and inspections.

7. For welds extending to the edge of the flange, locate a run-off block at the edge to obtain a continuous weld without undercuts. After welding, the run-off block should be cut off and the weld should be ground and inspected as in Steps 5 and 6 above.

8. Electrodes: Only low hydrogen electrodes should be used. These should be purchased in hermetically sealed containers or dried for 2 hours at a temperature between 232°C (450°F) and 260°C (500°F). After drying, the electrodes should be stored in an oven at a temperature of at least 121°C (250°F). If exposed to the atmosphere for more than 4 hours, the electrodes should be dried before use. Any moisture introduced into the weld could develop porosity or embrittlement, leading to further cracking.

NOTE: Welding procedures will vary among different frame materials. Refer to the specific type material and weld procedure.

G. Weld Recommendations for High Strength Low Alloy Steel Frames (50,000 and 80,000 PSI Yield Strength)

NOTE: Any of the electric arc methods previously described may be used. The choice of a suitable electrode or wire depends somewhat upon the equipment available for welding and the method selected.

The SMAW and the GMAW methods (see above) are preferred for welding the HSLA frames. The use of low hydrogen electrodes is recommended. Refer to Tables 1 and 2 for selection of recommended electrodes and wires, or refer to A.W.S. A.5 standard available from:

American Welders Society
2501 N. W. 7th Street
Miami, FL 33125

For equivalent strength electrodes, wires or rods and power leads to be used in the welding methods. The double V-notch weld preparation using the weld procedure shown is the preferred welding method. Refer to Figure 2.

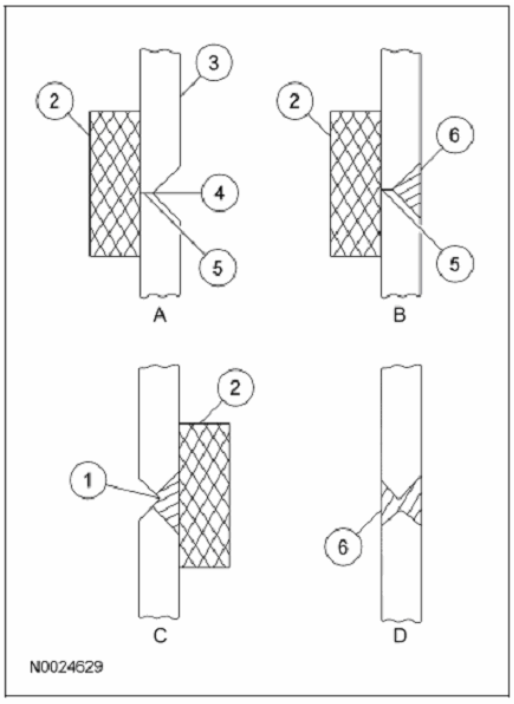
Table 1: SMAW Method (HSLA Frames)

Position	Electrode Sizes Inch	Amperes	Volts	Speed (Inch/Min.)
Flat	0.125	—	—	—
Horizontal and vertical	0.125	110/140	20/14	24

Table 2: GMAQ Method (HSLA Frames)

Position	Electrode Sizes Inch	Amperes	Volts	Speed (Inch/Min.)
Flat	0.035	—	—	350/400
Horizontal and vertical	0.035	190/220	20/30	350/400

1. Preheat the frame member along the prepared weld joint to 500-600°F (260-316°C). Make sure the area is clean and any moisture present is eliminated.
2. Permit heated area to cool to 93°C (200°F) or below before welding is started. The weld repair area must be clean before welding.
3. Either alternating current or direct current reversed polarity, combined with a short arc and beading or narrow weave technique, may be used. Direct current reversed polarity is recommended.
4. Slag should be removed after each pass and an interpass temperature of 93°C (200°F) should be maintained.
5. Grind smooth and flush with surrounding sidemember material. Grind the weld in a direction that is 90 degrees to crack direction. Refer to view D of Figure 2.
6. Add reinforcement.



Use of Chill Strip

Item	Part Number	Description
1	—	V-groove into sound metal
2	—	Copper chill strip
3	—	Frame rail
4	—	V-groove
5	—	Joint
6	—	Weld-ground with frame, grind in longitudinal direction of sidemember

Figure 2: Use of Chill Strip

H. Weld Recommendations for Heat Treated Frames (120,000 PSI Yield Strength)

NOTE: When welding Heat Treated Frames (120,000 PSI Yield Strength), use low hydrogen electrodes which have superior crack resistance and notch toughness similar to AWS-E-11018. This type electrode should be stored in a moisture-free container to avoid porosity during welding. Amperage and voltage recommendations for welding are shown in Table 3.

Table 3: SMAW Method (Heat Treated Frames)

Position	Amperes	Voltage
Downhand	130/140	21/23
Overhead	130/140	21/23
Vertical up	110/120	22/24

1. A heavy copper ‘‘chill’’ strip should be clamped to the rail side away from the groove to help control the temperature and cooling rate during welding. Refer to Figure 2. Short lengths of discarded heavy copper electrical bus bars make suitable chill strips.

2. Preheat the frame rail along the crack area to 260-316°C (500-600°F). Either alternating current or direct current reversed polarity, combined with a short arc and a beading or narrow weave technique may be used. Direct current reversed polarity is recommended.

3. Slag should be removed after each pass and an interpass temperature of 93°C (200°F) should be maintained. Grind smooth and flush with surrounding sidemember material, in a direction that is parallel to the longitudinal axis of the sidemember. Refer to view D of Figure 2.

4. A V-groove is ground from the side opposite the repair and the procedure outlined above repeated. ‘‘Chill’’ strips should be used whenever possible. The V-groove ground on the opposite side of the repair should be deep enough to enter the sound metal of the first weld repair. Refer to view C of Figure 2.

Sincerely,

(Signed)

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D. J. Snyder
SVE Quality Programs